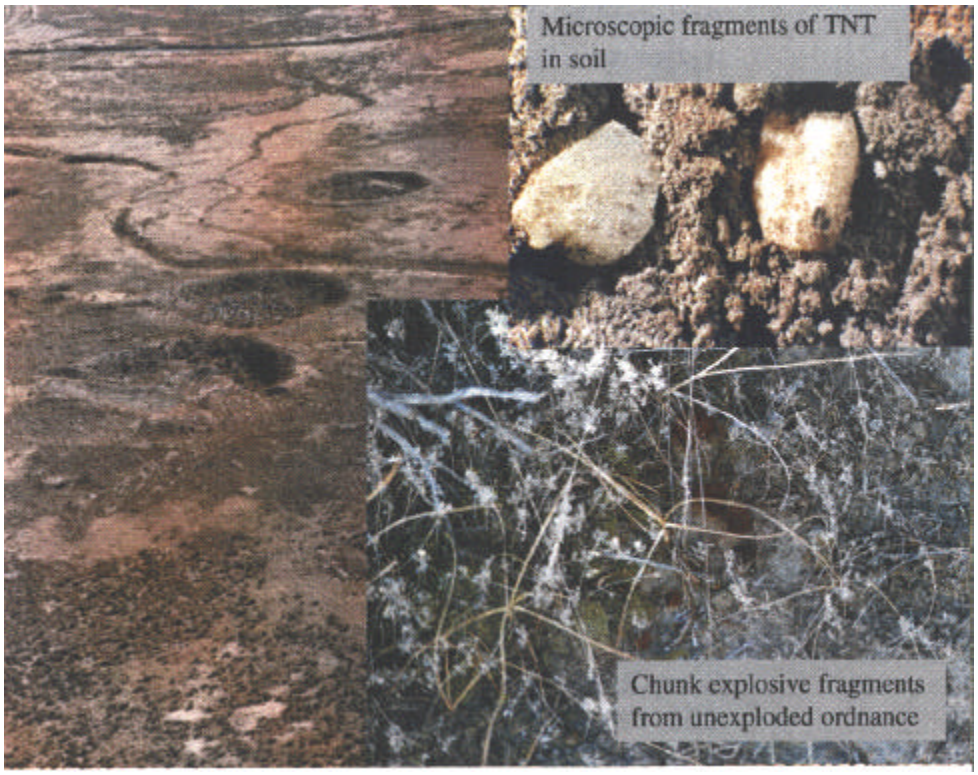
INEEL Biotechnologies Department

Bioremediation of Explosives

A team of scientists and engineers at the Idaho National Engineering and Environmental Laboratory (INEEL), managed by Lockheed Martin Idaho Technologies Company (LMITCO), has developed effective systems for the remediation of explosives-contaminated soils and wastewater.



Explosives in Soil

A number of biotreatment strategies and systems for remediating explosives-contaminated soils have previously been proven effective on screened soils or soils devoid of sizeable explosive particles. In contrast, solid explosive chunks within a soil matrix such as those present at the INEEL, constitute a major problem in the bioremedation of a contaminated site. Complete biodegradation of a solid chunk of TNT in soil is different to achieve because little of the contaminant is available to microorganisms which degrade it (TNT is soluble in water at 100 to 200 µg/mL). A pretreatment which renders the soil/chunk explosive matrix amenable to conventional biotreatment technologies has been developed at the INEEL. We are currently refining the systems necessary for integrating the physical/chemical pretreatment with the appropriate modifications of proven biotreatment technologies such as composts or soil bioslurries (see graphs on reverse).

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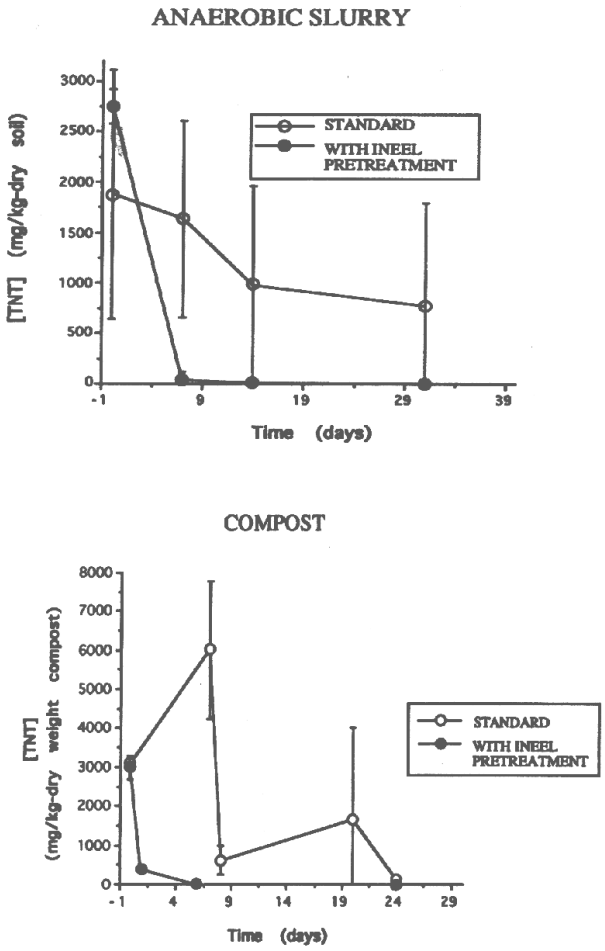
Effects of Physical/Chemical Pretreatment on Explosives-Contaminated Soil Biotreatments



Explosives in Aqueous Waste Streams

We have also developed an immobilized cell bioreactor system capable of degrading 2,4,6-trinitrophenol (picric acid) in an aqueous waste stream. The reactor utilizes a degradation pathway in which picric acid (as picrate) is the main carbon and energy source. The resulting system degrades picrate completely, as evidenced by stoichiometric nitrate release. After a series of reactor optimizations, the process handles up to 4,000 µg/mL picrate with a residence time of 1.5 days. The system is currently being scaled up for application at a small remote hazardous waste site.

Staffing and Facilities

The INEEL has a multidisciplinary technical staff and facilities to provide RCRA and CERCLA Treatability Studies for explosives remediation and environmental restoration with the capability to develop novel systems to address site-specific technical complexities.

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